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TUBERCULOUS ABSCESS OF THE THYROID GLAND*

Report of a Case

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SINCE the middle of the nineteenth century, when Rokitansky made the positive statement that tuberculosis did not affect the thyroid gland, there have been more than 250 cases of this condition reported in the literature. The majority of these cases were found at autopsy and in many disease of the thyroid gland was not suspected. Such cases are of little interest from the viewpoint of diagnosis and treatment of disease of the thyroid.

The first paper on this subject to appear in the American literature was published in 1917 by Mosiman.¹ He reviewed the literature, which was almost entirely European, and presented 9 cases treated surgically at Crile Clinic. In an excellent discussion of "Tuberculosis of the Thyroid Gland," Collier and Huggins give a comprehensive review of the literature and report 5 cases found in 1,200 thyroidectomies performed between 1921 and 1926.² In 1932 Rankin and Graham recorded 104 cases of surgically treated tuberculosis of the thyroid from the literature.³ To these they added 21 cases found in the course of the microscopic study of 20,758 thyroid glands removed surgically at the Mayo Clinic over a period of 11 years. Of this total 125 cases, 82.3 per cent, were found in females, 13.7 per cent in males and in 4 per cent the sex was not stated. In only 6 of these patients was there evidence of tuberculosis elsewhere in the body.

In order to infect the thyroid gland tubercle bacilli must enter it through the lymphatics, or must, as is more commonly accepted, be

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carried to the gland by the blood stream. Tuberculosis of the cervical lymph nodes may follow entry of tubercle bacilli through the tonsils. Such an infection may spread to the thyroid gland or may infect the thyroid without causing obvious lesions in the cervical nodes. Such a mode of entry may explain some of the reported cases of tuberculosis of the thyroid gland where no evidence of tuberculosis is found elsewhere in the body.

It is not possible to state the manner of infection in the individual case except in the presence of a massive hematogenous spread of tuberculosis. Some pathologists believe that careful examination in cases of miliary tuberculosis will reveal tubercles in the thyroid gland in a high percentage of cases. However, the interesting cases of thyroid tuberculosis are those in which miliary tubercles are found in the gland and yet tuberculosis is not evident in other tissues of the body. Furthermore, the removal of the infected gland seems to effect complete cure. Almost certainly the tubercle bacilli in this type of thyroid tuberculosis entered the gland through the blood stream.

According to Coller and Huggins the miliary type is the more frequent and, from the standpoint of diagnosis, the less important of two types of tuberculosis occurring in the thyroid gland. This form of the disease is characterized by multiple, small tubercles scattered through the substance of the thyroid gland. Of the 21 cases of tuberculosis of the thyroid reported by Rankin and Graham, 17 showed a diffuse miliary process.

German demonstrated tubercle formation in the thyroid gland and presented evidence that these tubercles were due to some other cause than tuberculosis.⁴ Since the tubercle is a local tissue reaction and may be simulated by syphilis, tularemia, leprosy lesions and foreign body reactions, German felt that an irrefutable diagnosis of tuberculosis of the thyroid depends on the demonstration of the tubercle bacilli. Louria and Louria, Smith and Leech, Jaffe, and others share this opinion.⁵⁻⁷

The second and more chronic tissue reaction to the tubercle bacillus in the thyroid gland is caseation. This probably begins as a conglomeration of tubercles and as caseation necrosis takes place, a mass is produced. The tuberculous lesion is not bounded by the capsule of the thyroid gland so that the inflammatory process may extend to adjacent tissues causing fixation. The mass of caseous necrosis may progress to liquefaction forming a tuberculous abscess. Rankin and Graham state that the progression of the disease to form such an abscess is extremely rare, and they list only 6 surgically treated cold abscesses among 104 cases recorded from the literature.

Uraz, in 1938, discussed cold abscess of the thyroid gland and presented 8 cases from the literature in addition to one of his own.⁸ In 1944 Postlethwait and Berg reviewed the literature and were able to find 26 cases of tuberculous abscess of the thyroid.⁹ Their own case and one added recently by Klassen and Curtis made a total of 28.¹⁰ Two of these cases were found at autopsy and had caused no symptoms before death. It is interesting to note that 16 of the 26 surgically treated abscesses of the thyroid gland occurred in males.

Tuberculosis of the thyroid is considered infrequently when making a differential diagnosis, and preoperative diagnoses are rare. More important reasons for the lack of accurate preoperative diagnoses are the non-specific signs and symptoms which may be those of non-toxic adenoma of the thyroid, a Riedel's struma or of Grave's disease. The basal metabolic rate may be normal or elevated. The patient may or may not have signs or symptoms of thyrotoxicosis.

The more prominent symptoms and signs of tuberculous abscess of the thyroid have been recorded by Postlethwait and Berg. They found that the duration of symptoms was less than 2 months in the majority of cases. In all of the surgically treated cases the presenting symptom was swelling in the neck. Dyspnea and dysphagia occurred in about one third of the cases. Rarely did the patients complain of pain.

The most consistent sign was a mass in the region of the thyroid gland. The mass was usually smooth and seldom fixed to the surrounding tissues. The mass was more often firm rather than fluctuant and was found to be tender in one third of the cases. The signs of inflammation of the overlying skin were seen occasionally.

Treatment of tuberculous abscess of the thyroid gland is influenced by the physical findings in the individual case. If the mass is fluctuant, or there are signs of inflammation in the overlying skin, the abscess should be incised and drained. However, if the mass is definitely confined to one lobe and is firm and freely moveable, subtotal thyroidectomy is the treatment of choice.

Of the 26 surgically treated cases of cold abscess found in the literature, 17 were incised and drained. Retarded healing usually followed. Four cases received postoperative roentgen therapy in an attempt to accelerate healing.

In the majority of cases complete recovery followed surgical treatment of the cold abscess. In the above mentioned collected group of 26 cases of tuberculous abscess of the thyroid, 3 died. One patient, a 55 year old woman, died of purulent mediastinitis shortly

after the attempted removal of the thyroid. The second, a 9 year old girl, died of miliary tuberculosis and tuberculous meningitis 7 months after incision and drainage of a cold abscess of the thyroid. The third case was that of a 64 year old man who died of an erosion of a large vessel 4 months after excision of the left lobe of the thyroid. At operation a fistula was found between the esophagus and the abscess in the thyroid.

CASE REPORT

M. J. W., a 64 year old colored female, was admitted to this hospital on June 9, 1947, complaining of a mass in her neck.

Her present illness had begun in the spring of 1944 when she developed a scratchy sensation in her throat associated with a persistent dry cough. She denied hemoptysis. In May, 1946, a roentgenogram of her chest, taken at a neighborhood health center, was reported as follows: "Some infiltration second interspace trunk upper right, and right base. Possible active tuberculosis. Classification 7." In the ensuing year she had 7 more roentgenograms of the chest. No agreement was reached on the diagnosis; however, each examiner mentioned tuberculosis as the first impression. No positive sputum was obtained.

In March, 1947, the patient noticed a mass on the right side of her neck. Her physician prescribed a "red medicine" to be taken 10 drops 3 times a day. After 3 weeks of this medication she thought the mass was smaller. Occasionally the mass was tender and at these times she had a choking sensation. She denied any recent change in her weight.

Physical Examination: On admission her temperature was 98.6, pulse 84, respiration 19, blood pressure 120/78, and weight 145 pounds. She was a well developed and well nourished elderly colored female who did not appear acutely ill. She had a dry cough. There was a firm, smooth, non-tender mass in the right anterior neck. The mass was approximately the size of a golf ball and extended slightly to the left of the midline, displacing the trachea to the left. Swallowing caused the mass to move.

A roentgenogram of the chest at this time showed patchy infiltration throughout the lower two thirds of the right lung field. Also, the trachea was displaced to the left and partially compressed by a soft tissue mass. The left lung field was clear. The radiologist suggested the possibility of a substernal thyroid or possible metastatic lesion within the right lung. He further recorded the fact that no metastatic lesions could be seen in the ribs and suggested that tuberculosis might give a similar picture.

The laboratory reported her red blood count to be 4.05 million, white blood count 8.9 thousand and hemoglobin 11.5 grams. Urinalysis revealed no albumen or sugar. The blood Kahn was positive. The basal metabolic rate was checked twice and reported as minus 6 and minus 2.

On June 17 the patient was taken to the operating room, and under local anesthesia a Kocher incision was made. On exposing the thyroid gland, the left lobe appeared normal. The right lobe was almost entirely involved by the previously described mass. The mass had a rubbery feel and was firmly attached to the right sternothyroid muscle, right carotid sheath and trachea. It was necessary to remove a portion of the prethyroid muscle and carotid

sheath with the tumor mass. The lower pole of the mass was found to extend behind the right sternoclavicular junction and was adherent to the parietal pleura at the right apex. While freeing the lower pole of the mass in this area the pleura was inadvertently opened. The wound was closed leaving one



Fig. 1. Gross specimen showing the thick walled abscess cavity.
The dark tissue is thyroid.

rubber tissue drain in the area from which the right lobe of the thyroid was removed. This drain was removed on the fifth postoperative day.

The patient received small doses of roentgen therapy to prevent fistula formation. Primary healing occurred.

She is being treated for pulmonary tuberculosis.

Pathologist's Report: The specimen (fig. 1) was a firm, oval, rubbery mass measuring 7 by 4 by 3.5 cm. and weighing 42 Gm. There was a small bit of dark tissue at one end of the specimen, and adherent to the anterior surface there was a piece of muscle. On section an oval mass was found measuring 4 by 3.5 by 3.2 cm. The center of the mass was filled with a thick purulent material, which, when removed, left a cavity approximately 2.5 cm. in diameter. The wall was from .3 to .7 cm. thick and was lined with a yellow caseous material.

Microscopic Examination: To the unaided eye the stained section was roughly the shape of a horseshoe and had a light blue color. A small piece of red-staining tissue was attached to the apex of the "horseshoe." Under the microscope this red-staining tissue was normal thyroid gland while the light blue portion was the wall of an abscess. In the outer layer of the abscess wall scattered small acini-containing colloid were found. In the same layer there were some small typical tubercles. The main portion of the abscess wall was composed of chronic inflammatory tissue with strands of epithelioid cells and numerous giant cells of the Langhan's variety (fig. 2). The cavity was lined with amorphous pink staining material and much cellular debris. Carbol

fuchsin stains of many sections failed to show acid fast organisms. A culture for tubercle bacilli was positive after 30 days.

Diagnosis: Tuberculosis of the thyroid gland with tuberculous abscess formation.

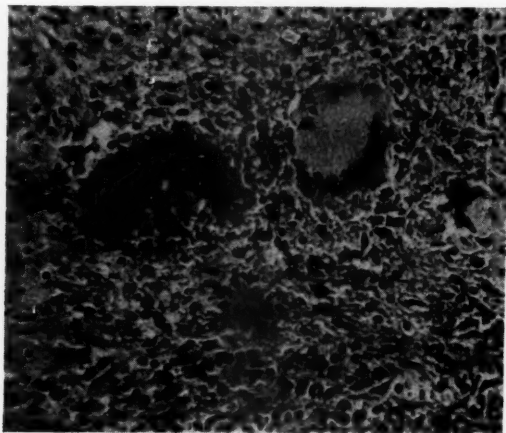


Fig. 2. Photomicrograph of wall of abscess showing Langhans type multinucleated giant cells and general tissue reaction. Discrete tubercles were found elsewhere.

DISCUSSION

Ours is the only case of proved tuberculosis of the thyroid found in 561 thyroidectomies performed at this hospital in the past 10 years. The diagnosis was not made preoperatively, but was made at the time of operation, and later substantiated by histologic findings and culture of the tubercle bacilli.

Because preoperative diagnosis of tuberculosis of the thyroid is rare, the surgical treatment will be the same as for that disease of the thyroid with the tuberculous process most nearly simulates.

Many writers have attempted to explain the rarity of tuberculous infections of the thyroid. Some contend that the thyroid gland is anatomically inaccessible. Others feel that thyroxin inhibits the growth of tubercle bacilli. The very adequate blood supply of the thyroid gland may be another factor. However, in his study on the "Pathogenesis of Tuberculosis," Rich has shown that increased vascularity with increased oxygen supply to a tissue favors the growth of tubercle bacilli. Probably the most important factor is that the thyroid is not rich in reticulo-endothelial cells, and that hematogenously spread tubercle bacilli are not phagocytized in the organ. This is in contrast to the frequency of tuberculosis in organs of the reticulo-endothelial system, as spleen, liver, lymph nodes and

bone marrow, and, to some extent, the lung, though there are other factors to explain the frequency of tuberculosis of the lungs.

What validates a positive diagnosis of tuberculosis of the thyroid gland besides typical histology? We feel that the demonstration of the tubercle bacilli, either in the tissue, or by culture on guinea pig inoculation, is important especially if, as in our case, the patient has syphilis.

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VASCULAR SPASM: A REVIEW

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INTRODUCTION

THIS paper purposes to review the recent literature—July 1940 to June 1946, and a few other references for sake of continuity—thereby summarizing the presentations on the subject of vascular spasm (and closely related subjects), both clinical and preclinical. A corollary purpose is to reemphasize that (1) destructive vasoconstriction, which may occur at, near, or distant from the site of trauma, is a frequent reaction to trauma; (2) the trauma need not involve major vessels directly; and (3) the traumata are of wide, and increasingly varied, kinds.

This first concept (v.s.) should assume a place of importance somewhere between its present obscure status and that of the generally accepted triple response of Lewis¹ in routine preclinical teaching—at least, so it appears to the writer after reviewing the groundwork which underlies this paper. In reference to the work of Lewis, it should be noted that Göpfert² reported that histamine in small amounts produced vasoconstriction, whereas larger amounts, in the same subject, produced dilatation. Also that Bach,³ by his own experiments and in corroboration of others (q.v.), suggests that histamine may result from any condition which produces circulatory stasis, and therefore may be an effect, and not the cause of the vasodilatation of the triple response. Harpuder and Stein,³³ however, failed to find histamine increased in blood samples taken from the ischemic arm.

The animal investigations have been set apart from the clinical because of the constant reminders of authorities that conclusions derived from the first cannot be carried over to the second. The section on treatment tends primarily to demonstrate the lack of uniformity among the many writers on this subject.

By this arrangement, if the reader wishes to limit himself to the clinical, the appropriate sections may satisfy him; on the other hand, ideas on the subject being as poorly crystallized as they are, perhaps any clinician could derive some benefit from the facts which have been contributed by the laboratory—hence their inclusion in this communication. It is a regrettable fact that a section on "Pathogenesis" is not justified.

BASIC PHYSIOLOGY (ANIMAL INVESTIGATION)

In order to give some definite basis to the clinical conclusion that

the smaller blood vessels are capable of contractility to the point of ischemia, Fulton and Lutz⁴ have demonstrated in the frog that the precapillary and capillary are capable of contraction by direct stimulation of a microscopically discernible nerve associated with them. Further, that the reaction is diphasic, the contraction being preceded by a brief period of dilatation; and that the contraction did not spread proximally to larger vessels.

Levenson and Essex,⁵ in an intentional investigation, showed that vasoconstriction occurred in a preparation of the rabbit's ear where the vessels were intact but the peripheral nerves sectioned, the stimulus being shock due to intestinal manipulation, suggesting a humoral origin of the constriction. (Objection will no doubt be raised that an ear with intact vessels is not truly denervated.)

In similar preparations, Landis, et al.,⁶ demonstrated that in the severed rabbit ear (no possibility of central nervous connection remaining) the vessels were capable of autonomous vasoconstriction, and that this reaction depended on the perfusant. Other factors being the same, the vessels reacted to defibrinated blood following a negative reaction to Ringer's solution, and that following the reaction with blood, the vasoconstriction could be "washed out" with more Ringer's solution. This seems to demonstrate more conclusively that local vasoconstriction may be a reaction to substances acting in the region of the constriction. There is a fair parallel to the "washing out" maneuver and the gradual lysis of clinical vasoconstriction on resumption of normal circulation. A related contribution on the question of humoral origin of vasoconstriction is that of Page,⁷ who demonstrated that a substance was contained in the blood of a shocked dog which would produce constriction when transferred to the rabbit ear. The shock was induced by a prolonged application of a tourniquet, calculated burns, 7 per cent hemorrhages (based on body weight) and stripping of the intestines; it was characterized by reaching its maximum level in 30 minutes, by being formed in dogs irrespective of the presence of kidneys and/or adrenal glands, and in spite of transection of the spinal cord below the second dorsal level. The substance is, furthermore, dialyzable through cellophane. Another group of investigators, led by Chambers,⁸ demonstrated that the "toxins" of shock may be constrictors early in course, neutral or dilators late in course, these being derived from the same animal. None of these investigations, apparently, were corrected for a possibility as pointed out by Green, et al.,⁹ that spontaneous changes in vasomotor tone (which these investigators relate to the clinical Traube Hering waves) may be of the order of 1.7/1 in the dog's hind leg.

Concerning the nervous thesis of vasoconstriction Phemister¹⁰

noted that prolonged stimulation of the aortic nerves of rabbits was required to produce shock (with occasional exceptions, 5 to 8 hours) and that an effective vasoconstriction was maintained during this long period. The stimulation of somatic nerves did not approach this degree of receptor insult. Phemister concluded that this type of stimulus may produce syncope and that, although it might contribute to shock established or imminent due to blood loss, it was not a primary cause. Barnes and Trueta,¹¹ on the other hand, imply that there is a definite nervous origin of the peripheral vasoconstriction because of the fact that severe spasm, produced in the hind limb of a rabbit by tourniquet, was reflected in the fellow limb as seen by direct arteriogram. "Local (intra-abdominal) infiltration of the sympathetics" failed to relieve the spasm, whereas sympathectomy did relieve the spasm of the collateral circulation but not of the main artery in 2 of their 5 sympathectomized specimens.

In relation to the effects of vasoconstriction, the representations of Mann, quoted by Shipley and Gregg,¹² have tended to be controverted by the latter authors who demonstrated that the degree of external constriction of a blood vessel does not determine its rate of flow for the reason that, without extrusion or lengthening, the cross sectional area of the lumen is decreased out of proportion to the external constriction. In fact, said Pappenheimer and Mays,¹³ the vasoconstriction resulting from hemorrhage may produce a peripheral resistance in perfused dogs' legs as much as twice that expected for the system without a change in apparent viscosity—apparent viscosity being defined as the ratio of the flow of Ringer's solution to the flow of defibrinated blood in the same preparation. In all fairness, it should be noted (v.s.) that Landis⁶ had noted autonomous vasoconstriction in another species with defibrinated blood. Concerning drugs which affect blood viscosity, Eckstein,¹⁴ et al, came to the conclusion that ether anesthesia increases viscosity in direct proportion to the depth of anesthesia, that barbiturates tend to decrease it and that heparin, morphine and defibrination do not alter viscosity. They also noted that: (1) hemorrhage reduces the viscosity after a short period; (2) that a drop of temperature produces an increase which, in the dog, was 2 per cent for each degree centigrade reduction of the body temperature; (3) that the specific viscosity of dog's blood is directly related to the hematocrit, with the exception of an inverse relationship in that part of their experiments which was devoted to the investigation of sodium citrate solution and a dye, pontamine pink.

An experimental basis for the use of lowered temperatures in the treatment of the patient with a hopelessly ischemic extremity has been indicated by Blalock,¹⁵ who showed that in dogs with a trau-

matized extremity tourniquets, applied and subsequently released, decreased their survival time and their percentage of survivals over controls; that icing the extremity halves the mortality, and that liberal doses of plasma further improve the survival time and mortality but slightly.

Fine, et al,¹⁶ using radioactively tagged plasma, present strong evidence to refute the capillary permeability theory of shock by showing that protein losses are negligible (except in regions of injury), and conclude that shock is due to stagnation of blood in peripheral capillaries—a result of the marked vasoconstriction which clinically characterizes the state.

In an almost entirely negative report, Abramson, et al,¹⁷ concluded that of the commonly used vasodilating drugs, only hypertonic salt solution produced immediate vasodilatation plethysmographically with a single dose. The drugs tested: calcium gluconate, Padutin, papaverin, Spasmalgin, thiamin chloride, alcohol, stilbestrol, histamine and 5 per cent sodium chloride. Intermittent venous occlusion was also of no value under this circumstance. But the article adds that clinical conclusions cannot be drawn directly from these findings.

CLINICAL PHYSIOLOGY

The term clinical physiology is used to encompass any investigations on the human subject. Since, as previous writers have pointed out, the subject of arterial vasospasm cannot successfully be separated from those of pain and shock, and since light is thrown on their relief through the investigations concerned with those factors that influence the rate of blood flow, this subject becomes a catch-all for many investigations which may be considered pertinent to the matter. A similar review of this assorted information was written by Smith and Grodins¹⁸ in 1941 and contains bibliography of the information up to that time.

In regard to the factors influencing blood flow, Abramson,¹⁹ et al, noted that in normal adults anoxia produced an increase in blood flow through the leg and forearm and a decrease through the hand, accompanied by increase in pulse, the depth and/or rate of respiration, but no change in blood pressure. It was pointed out that since the resting limb requires only a small portion of the oxygen delivered peripherally, no necessity for marked increase in the rate of peripheral blood flow (as a mechanism compensatory to the anoxia) is to be expected. Warren, et al,²⁰ demonstrated that the effect of increasing blood flow by the heating of the normal forearm produced as great a vasodilatation as sympathetic novocainization, and state that there is no need, therefore, to assume that there may be

sympathetic vasodilator fibers—an argument which will be taken up a little later. These investigators also demonstrated that the constriction of pain is a stimulus stronger than the relaxation of heat, suggesting the futility of heating a painfully injured extremity. They then blocked the sympathetics and additional vasodilatation was produced in the presence of the pain. In the painless forearm, local and general heating (of the body) produced adequate effect, but was no greater than the single effect of sympathetic block. These conclusions were drawn from detailed experiments on one subject. Naide²¹ devised a clinical test for grading vasospasm. Based on response of peripheral vessels to heating of the trunk, a gradient was computed for the hand-foot relationship. This is reminiscent of the studies of Atlas²² wherein the gradient was established for oscillations of the hand-foot relationship in arteriosclerosis.

Abramson, et al,²³ then investigated the relation of peripheral blood flow to edema and came to the conclusion that edematous limbs demonstrate a greater minute blood flow than normal limbs, in those patients with normal cardiovascular systems. One might interpret this finding as suggesting that ischemic limbs would tend to require more blood when there is evident edema. From this same clinic came a second study²⁴ relating vascular response and anoxia, this time including the leg, and the same conclusion was drawn regarding the lower extremity as had been with the upper, again pointing to the suggestion that in an injured extremity the fate may depend on the balance between the demand for oxygen, the ability of the blood to carry it, and the relative activity of the part. This group²⁵ then investigated the relation of peripheral blood flow to anemia and concluded that anemia also increases blood flow through the forearm but not through the hand. (The hand, it is repeatedly pointed out, is a very special member, unsuitable for gauging blood flow relations because of its lability, responding quickly to psychic, thermal and other stimuli.) The information gained from this study serves to emphasize that blood replacement is a paramount consideration in the treatment of a damaged vascular supply accompanied by spasm.

A discussion of the additions to the much involved subject of the presence or absence of vasodilator fibers: Miller and de Takats²⁶ show what well appears to be objective evidence of the *reduction* of blood flow after a sympathetic interruption in clinical cases of Sudeck's atrophy. In subsequent communications, de Takats^{27,28} produced other cases to emphasize this thesis. Previously mentioned, Warren, et al,²⁹ presented evidence against the vasodilator fibers. Then again, Faust²⁹ presented the opinion that in traumatic cases, vasodilatation is a reflex, and not a passive function.

Bordering on the question of shock, Stead and Warren,³⁰ working on two different subjects' brachial arteries into which histamine was injected, demonstrated that histamine produced local hemoconcentration without a corresponding hyperproteinemia, and may be interpreted as suggesting that the protein is actually lost into the tissues. They stated that a reaction similar to that produced by histamine is not seen in the intact tissues of shock. In other words, they controverted the theory that shock is caused by generalized capillary injury and generalized protein loss from blood to tissue. On the subject of shock, Rushmer³¹ has produced an interesting group of graphs which demonstrate that generalized syncope grossly simulating early shock may be produced by minimal injury to the brachial artery and suggests a relation to "primary neurogenic shock." Henderson³² has published another of a series of articles tending to show that shock may be due, at least in part, to the failure of the venous return, a function dependent on muscle tonus. If one is so inclined, a primary neurogenic causation may be read into this interpretation also.

On the subject of pain, Harpuder and Stein³³ made interesting observations, on a limited number of subjects, which strongly suggest that the pain of ischemia comes on only in a limb which has simultaneously exercised, or has been exercised vigorously just prior to ischemia. The pain is related, in their opinion, only to some factor of the potassium ion concentration of the extremity, and that the pain is not due to anoxia alone. This is demonstrated by the fact (1) that the arm may remain tourniqueted 20 to 30 minutes without producing serious pain, and (2) that partial ischemia, accompanied by exercise, will produce pain. Taking the finger as a non-muscular organ, it was observed that a limited type of skin burning, but no cramping pain, may be produced by total ischemia, suggesting that the pain of ischemia is due to actual cramping of the muscle and not to the stimulation of sympathetic receptors in the walls of blood vessels.

CLINICAL CASES AND TENTATIVE CLASSIFICATION

The author was dismayed at the paucity of reported cases found in the literature for the period encompassing the recent war, and deduces that this may be due to the fact that (1) war experiences have not yet found their way into the literature in quantity, and (2) cases of vascular spasm are frequently otherwise classified clinically.

The cases have been set out in chart form (fig. 1) indicating the authors, the numbers and types of cases and their treatment, and the approximate result. "Partial ischemia" has been used to describe the state of a limb which resulted either in a clinical Volk-

FIGURE 1

Vascular Spasm (including Volkmann's Ischemic Contracture): Clinical Cases from the Literature 1940-46

Author	No. Cases	Cause of Spasm	Treatment	Results		
				Re- lieved	Gan- grene	Partial Ischemia
Ochsner- De Bakey ³⁵	15	Thrombo- phlebitis	Sympathetic block	X		
Rankin ³⁶	1	Osteoma, femur	Excision	X		
Edwards ³⁷ (chronic forms of spasm)	3	Hypertrophic arthritis	Diet; heat	X		
	1	Fractured vertebra involving cauda equina	Laminectomy	X		
	1	Neuritis (sciatic)	X-ray treat- ment	X		
	1	Scar (neu- roma?)	Excision	X		
	1	Phlebitis	Excision vein	X		
	1	Phlebitis	Heat	X		
	1	Cervical rib with symp.	No treatment (refused)			X
Griffiths ³⁴ (collected cases)	12	Fracture about elbow	Set fracture			X X (Volk- mann's)
	2	Fracture about elbow	Arterectomy	X		
	11	Fractured forearm	Set fracture			X (Volk- mann's)
	1	Fracture of wrist	Set fracture			X (Volk- mann's)
	1	Crushing of upper limb	Arterectomy	X		
	3	Arterial embolism	Embolectomy			X (Volk- mann's)
	8	Arterial embolism	Embolectomy		X	
	3	Arterial embolism	Embolectomy	X		
Cohen ³⁸ (collected cases)	1	Fracture of humerus	Stripping		X	
	1	Fracture of humerus	Arterectomy		X	
	1	Crushing in- jury and shock-spasm in 2 vessels				
	1	Burned forearm	For shock Ag NO ₃ & cast	Died		
	2	Dislocation of shoulder	Arterectomy	X		
	1	Gunshot wound: contused vessel	Debrided	X		
						X

FIGURE 1 (continued)

Vascular Spasm (including Volkmann's Ischemic Contracture): Clinical Cases from the Literature 1940-46

Author	No. Cases	Cause of Spasm	Treatment	Results		
				Re- lieved	Gan- grene	Partial Ischemia
Elkin ³⁹	1	Dislocation of elbow	Reduction, cast			X (Volkmann's)
	1	Gunshot wound Brachial artery plus compound fract. elbow region	Immobilization and Penicillin		X	
	1	Traumatic "aneurysms" (2 in number)	Excision			X
Beck ³⁹ (Disc. of above paper)	1	Trichophytosis of feet	Not stated			X (ulcers)
Livingston ⁴⁰	1	Gymnastics: sprained foot (?)	Sympathectomy	X		
	1	Hiking: sprain (?)	Somatic nerve injections	X		
Henry ⁴¹	3	Compound fractures	Lumbar symp. blocks	X		
Clark ⁴²	1	Simple fracture tibia and fibula	Steinman pin & cast		X	
Sirbu, ⁴³ et al	1	Simple fracture of tibia	Lumbar symp. blocks	X		
	1	Simple fracture of tibia	Decompression of Popliteal space		X	
	1	Comp. fract. both bones of leg	Spinal anesthesia & reduction	X		
	1	Comp. fract. both bones of leg	Spinal anesthesia; late arterectomy (30 hours)		X	
	2	Joint fracture tibia and fibula at knee	Pentothal; cast			X (Volkmann's)
	1	Muscle hernia	Closure		X	
	1	"Shin splints"	Decompression		X	
MacKenzie ⁴⁴ and Breckenridge	1	Simple fracture tibia and fibula	Traction & symp. blocks		X	
Bisgard ⁴⁵		Gunshot wound, Popliteal space	Explored (negative); blocks			X (Volkmann's)
Tunick, ⁴⁶ et al	1	Ligation—Retrograde vein injection	None			X (Volkmann's)
	1	Ligation—Retrograde vein injection	None			X (Claudication)

mann's contracture or other results between complete relief and extremity gangrene, e.g., loss of skin, or a toe or two.

Of the cases reported, it will be seen that most are single cases (suggesting that the authors considered incidents of severe vascular spasm an unusual occurrence) and that most of those that resulted in gangrene complicated fractures. Of the gangrenes, more derived from simple fractures than compounded ones in ratio of 5:2. From the reciprocal viewpoint, 34 simple fractures were reported as producing severe arterial spasm which, after treatment, produced the following accumulated results: 4 were relieved (12 per cent), 5 (15 per cent) went on to gangrene and 25 (74 per cent) produced a Volkmann's contracture. (This is especially weighted by the collected cases, reported by Griffiths³⁴ which were compiled from the standpoint of this subject—i.e. Volkmann's). Of the compound fractures, 4 of 6 were relieved (66 per cent) whereas 2 went on to gangrene. Statistical value probably should not be attached to the reporting of these "bad" cases.

The next largest group of cases numerically—also reported by Griffiths (v.s.)—were the arterial embolisms, 19 in number. All were treated by embolectomy with the following results: 8 (42 per cent) fell into each of the groups "relieved" and "gangrene," whereas 3 (16 per cent) resulted in Volkmann's contracture.

Next in numerical importance were the 15 cases of thrombophlebitis reported by Ochsner and De Bakey,³⁵ all of which cases were relieved by sympathetic blocks.

The remainder of the cases fall into no well-defined category. A number of new causes for vasospasm were reported.

From the cases reported during the period covered by the review and from generally accepted material previously reported, the following tentative etiologic classification of vascular spasm is offered, primarily to emphasize the variety of conditions with which the phenomenon is associated. "Etiology" is obviously used in a very loose sense as the chart includes conditions, accompanied by spasm, which themselves are of unknown etiology (fig. 2).

FIGURE 2

Tentative Etiologic Classification of Vascular Spasm

I. Exogenous

A. Complicating direct trauma to vessels

1. Transection—complete or partial
2. Contusions
3. Surgical trauma

- a. Debridement
 - b. Operations on vascular system
 - c. Vasopuncture
- 4. Vibratory tools (?)
- B. Complicating trauma to neighboring structures without apparent injury to vessel.
 - 1. Muscles—"looping" of Cohen?
 - 2. Fractures
 - 3. Dislocations
 - 4. Sprains and Strains
 - 5. Burns
 - 6. Frostbite
- C. Infections
 - 1. Anterior poliomyelitis (?)
 - 2. Trichophytosis
- D. Due to drugs, ergot, adrenalin, or to tobacco
- E. Concomitant with shock from remote injuries
 - 1. Involving an isolated (second) vessel
 - 2. Involving crushing injury of another extremity
- II. Endogenous
 - A. Of known origin
 - 1. Complicating bone tumor
 - 2. Result of muscular activity
 - a. "Shin splints"
 - b. Cervical ribs, scalenus syndrome, neurovascular syndrome
 - c. Spontaneous rupture
 - 3. Embolism
 - 4. Known types of hypertension
 - 5. Arteriosclerosis
 - B. Of unknown origin (or pathogenesis)
 - 1. Arthritis
 - 2. Neuritis
 - 3. Chronic peripheral vascular disease
 - a. Buerger's disease
 - b. Raynaud's disease or phenomenon
 - c. Scleroderma
 - 4. Essential hypertension
 - 5. Of psychosomatic origin

TREATMENT

The specific treatment directed toward the relief of vascular spasm is usually found as part of the general treatment of vascular injuries, and in connection with elective vascular surgery. Since

these general treatments are closely related to the relief of spasm, the opinions of the following writers are reviewed as they appeared in relation to the broader topics.

De Takats⁴⁷ recommended the following measures: immediate control of hemorrhage by suture, clamp or anastomosis by tying in a glass cannula and giving heparin; papaverine in $\frac{1}{2}$ grain doses intravenously; heating of body and limb root above interruption; sympathetic block with procain. For crush injuries, he mentions pneumatic cuff delivering subdiastolic pressure, to prevent renal failure.

Telford,⁴⁸ who indicated that he believes spasm may be initiated either as a local or cord-level reaction, advised sympathetic block but apparently did not expect results in all cases. He advocated a dependent position, and "cautious use" of local heat and general heating.

Pratt⁴⁹ advocated the use of a clamp for hemostasis, when possible, or a tourniquet with a padded object over the vessel; vein grafts; heparin and dicumarin; direct suture when feasible. On spasm, he recommended "external heat 88-96°" (apparently to the limb); varying the position of the extremity up and down (or oscillating bed); abstinence from tobacco; use of whiskey, pantopon, papaverine, atropine, and deproteinized pancreatic tissue extract; sympathetic block.

Holman⁵⁰ advocated elevation of the extremity, after repair of artery, along with cast immobilization for 2 weeks and bed rest for one month. He emphasized massive transfusion, novocain sympathetic blocks or sympathectomy at the initial operation when a major vessel was ligated. He inveighed against drains, and the ligation of major concomitant veins unless the distal stump of the vessel pulsated (Henle-Coenen phenomenon).

Anderson⁵¹ pointed out that since vasoconstriction is both a physiologic and pathologic state, the first consideration for its relief is the adequate treatment of shock in order to restore the blood pressure to suprashock levels; general warmth but not to the extremity above 90 degrees; 10 to 15 degrees dependency depending on where color is optimum; no tobacco; administration of papaverine, sodium nitrite, nicotinic acid, alcohol, opiates for control of pain; local infiltration about fracture sites associated with blood vessel injuries; sympathetic block, spinal anesthesia and local infiltration, around site of vessel injury, may be used. He also pointed out that when the injury is one of veins, immobilization is contraindicated, elevation is in order, ligation is practiced when the thrombosis appears to ascend, and heparin should be used.

Bowers⁵² regards heat as dangerous and advocates direct refrigeration with ice bags. He has applied the wheal fluorescence test to cases of trauma as did Neller and Schmidt⁵³ to peripheral vascular disease, modifying the technic somewhat. He differs from the latter authors and Massell⁵⁴ on the interpretation of the timing of the test.

Allen⁵⁵ concludes, from animal experiments incomplete at the time of writing, and from clinical experience with patients, that refrigeration is an established treatment for ischemic or infected extremities, and suggests that general hypothermia is the logical next step in the treatment of shock.

De Takats and Miller⁵⁶ found that as much heating could be produced in arteriosclerotic limbs reflexly as by direct heat; and observed that the latter aggravated pain and accelerated gangrene in clinical cases.

On the subject of sympathetic ganglion blockage, as late as 1944 a British War Memorandum⁵⁷ showed that the Medical Research Council did not accept the procedure as effective against arterial spasm, and recommended periarterial sympathectomy, limb cooling, conservative application of repair by suture in conjunction with heparin and in 1945 Siddons⁵⁸ reviewed the subject, pointing out a great deal of evidence to refute its utilization in traumatic cases. He also emphasized the evidence leading to the conclusion that sympathetic blockage directs blood from muscles to skin. At approximately the same time, the U. S. Army dictum, written by De Bakey,⁵⁹ endorsed "blocks" twice daily if necessary.

Gage and Ochsner⁶⁰ extended the indications to the preventive field, in operations on the vascular system, in order to prevent ischemic gangrene following ligations for traumatic aneurysms and other conditions. They deplored the ligation of concomitant veins as unnecessarily reducing blood flow to a limb, which flow can be maintained by measures to develop the collateral circulation. These measures were described.

Crile,⁶¹ in a summary of treatment, advocated sympathetic blockage, whiskey, oxygen by inhalation, cooling but not refrigeration, interdiction of tobacco. Icing was admitted for amputation. Heat was interdicted. Blakemore tubes were mentioned, having been applied successfully in 2 cases of arteriovenous aneurysm. This author, like Telford (v.s.) believes that "blocks" are not always effective because segmental spasm may be due to local reflexes in the vessel wall.

In a report of the amputations performed by medical units of the Third Army, Odom⁶² stated that the gangrene rates in the field

were: for arteries repaired, 38 per cent; for ligations, 57 per cent. Admittedly, favorable cases (general condition, not anatomic sites) were selected for repair. From this, one may infer that there is a 19 per cent salvage, even under mediocre conditions, when all arteries are repaired; and, by deduction, that spasm accounts for this difference. Sympathetic blocks were "disappointing" in their results.

The preceding article is, in tone, a definite about face from the futility expressed by Bernheim,⁶³ 4 years previously, as he recounted his experiences (rather, complete lack of application) with blood vessel suturing in World War I.

In a report on the experiences of an Evacuation Hospital with blood vessel surgery Rose, et al,⁶⁴ thought that "thrombosis and spasm of the distal arterial tree are the greatest detriments to success." They advocated sulfonamides, penicillin, transfusions according to the hematocrit, lowering the extremity, alcohol, papaverine, icing, sympathetic blocks which were admittedly impossible to evaluate in borderline cases. "In no case did this procedure appear to reverse the progress from an avascular state in patients with severed (main stem) arteries," they stated; yet later concluded "it was of value in arterial spasm."

And again Holman,⁶⁵ in correspondence addressed to Matas during a Pacific campaign, stated, "... lumbar sympathetic interruption . . . in no instance saved a limb from amputation." He was the only one of the writers reviewed who pointed out the possible danger of relapse into shock with lumbar blocks. The author has had this experience also.⁶⁶ Holman stressed restoration of blood volume, and noted that refrigeration arrested established gangrene at the level present when the ice was applied.

In summary, then, the present predominant view of the treatment of spasm, other than that for shock, is the finding and relieving the cause of reflex vasoconstriction. In an article outlining the emergency treatment of acute vascular injuries, de Takats placed the "mental equipment" first, the physical second. The supporting measures which serve to decide the fate of an extremity between the time of an injury and the relief of the spasm are those which are generally directed at maintaining oxygenation of tissue as follows: (1) adequate replacement of blood cells so that oxygen-carrying capacity may be restored to normal per unit volume of blood; (2) increasing to normal the oxygenation to the damaged parts (the hematocrit usually being reduced) by the constant inhalation of an atmosphere of increased partial oxygen tension; (3) repeated regional sympathetic block in an attempt to relax and maintain normal tone of the spastic vessels, or ganglionectomy for elective surgery

in late traumatic, and degenerative disease, cases; (4) posturing of the extremity for maximum delivery of blood and avoidance of external pressure which may be transmitted to, and serve to occlude, vessels of substandard pressure; or oscillating bed; (5) maintenance of the estimated normal blood pressure for the individual; (6) vasodilating drugs, including papaverine, alcohol, possibly others, and avoidance of the noxious drugs, tobacco, adrenalin and other vasoconstrictors once the period of shock has been controlled; (7) operation to re-establish the circulation of the main stem artery when possible; (8) refrigeration—or cooling—of the extremity and heating of trunk or contralateral limb; (9) heparin and/or dicumarol (although there is an element of occasional danger from bleeding when used in conjunction with the repeated needling of sympathetic block, which may be avoided by the use of epidural block).

DISCUSSION

Although the exact mechanism or causation of vascular spasm has not been shown, it is now apparent that the phenomenon may accompany a wide variety of insults to the vascular system, both direct and indirect. A little doubt has been thrown on theories previously entertained quite comfortably, and new data has been introduced to suggest the direction that subsequent investigation may take.

These cases have been presented with the purposeful idea of showing that vasoconstriction is at least one form of reaction to injury. This concept, extended to other fields, may become useful in the everyday practice of general surgery. From it has arisen the practice of the French to excise segments of injured and diseased blood vessels^{67,68} for the relief of peripheral vascular spasm which has become generalized in an extremity. American practice has partly accepted arterectomy for trauma, but the present predominant treatment is toward earlier and more frequently applied sympathetic interruptions, usually chemical. War injuries have recently raised doubts in many minds as to the efficacy of the latter.

The relation of blood loss shock to spasm and peripheral nutrition is more generally agreed upon.

Although available since early in the war, the Blakemore⁶⁹ anastomosis is not yet effective in most hands, apparently—at least not in traumatic cases, its currently predominant application.

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EARLY RISING AFTER MAJOR ABDOMINAL SURGERY

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CONFINEMENT of patients to bed for relatively long periods following major surgical procedures is a deep-rooted tradition which most surgeons of the present era were taught in medical school, exposed to during their postgraduate training, and subsequently followed in their practices. However, in 1899, Emil Ries read a paper which was published in the *Journal of the American Medical Association* in which he stated: "The purposes of these changes (early ambulation) has been to free patients from many irksome and disabling features of after treatment as usually carried out, and at the same time to make their recovery more rapid and more complete so that they are able to leave the hospital at a much earlier date than has been customary, and in such condition of strength that they can follow their wonted occupations within a few days after their discharge from the hospital."

The clinical observations made by Ries 50 years ago fell, more or less, on deaf ears for only a few dozen papers were written on this subject prior to the present decade and, of the first 100 papers on the subject, only 4 were published in North American journals.^{2,3,4} Since 1941, however, when Leithauser and Bergo⁵ reported on 436 cases operated on by them, there has been a tremendous upsurge of interest in this idea. There is hardly a journal in this country that has not reported on this subject during the past 5 years through articles and editorials. Although there is not complete agreement among these observers on all points, it is important that, almost without exception, these authors are convinced that there are definite advantages to such a regime, while, in general, critics of early ambulation have self-admittedly had little experience with it and have based their criticism on one or a few unfortunate complications which may or may not have been justifiably attributed to early rising.

There has been considerable confusion in published reports as to what constitutes "early rising." Some surgeons who keep their patients in bed 5 and even 7 days^{3,6} have reported on "early rising." To others early rising is interpreted to mean less than 72 hours.⁷ Several European surgeons have recommended immediate rising. As suggested by Leithauser,⁸ by "early rising," I mean standing the patient for deep breathing and coughing exercises as soon as he has reacted from anesthesia and having him walk as soon thereafter as possible. This can usually be accomplished in 3 to 6 hours after completion of the operation where spinal anesthesia has been used.

(With general anesthesia usually a somewhat longer period is required; but rare indeed is the patient who cannot be made to stand and walk—without undue discomfort, and many times with considerable benefit—within the first 12 hours.)



Fig. 1. Miss S. K., aged 31 (second out of bed period). Six hours after right inguinal herniorrhaphy.

THE LAPAROTOMY SYNDROME

After surgery and anesthesia the normal efficiency of the mechanisms that have to do with respiration, circulation, digestion and the elimination of waste products is temporarily disturbed. There is crippling of the muscles of respiration, which can lead to anoxemia and atelectasis; a slowing of circulation, which can lead to thrombosis and embolism; a disturbance of the motor mechanism of the intestines and urinary tract which can, and frequently does, result in abdominal distention and urinary retention. In addition, biochemical changes result from cytolysis in the area of surgical trauma which affect metabolic and glandular activity. Inactivity in bed intensifies these disturbances, disturbances which Leithauser⁸ calls "the laparotomy syndrome." These changes, if prolonged, may lead to serious structural damage which may be called "postoperative complications." Rehn has said: "The bed is a veritable breeding place of postoperative complications."

PULMONARY COMPLICATIONS

MacLeod⁹ has stated that the recumbent position alone reduces

vital capacity 15 per cent, while Powers¹⁰ has shown that postoperative hypoventilation varies from 50 per cent in lower abdominal operations to 66 per cent in upper abdominal cases. Kromov,¹¹ on the other hand, has shown that there is a lessened reduction of vital



Fig. 2a. Mrs. C. M., aged 32. Diagnoses: Acute suppurative appendicitis; hemorrhoids, internal and external; anal fissure. Operation: (1) Appendectomy, (2) Hemorrhoidectomy, (3) Excision of anal fissure. Seven hours after operation (third out of bed period).



Fig. 2b. Mrs. C. M. at the time of her first office visit on the 6th postoperative day.

capacity with the use of early rising in postoperative patients; while Leithauser⁸ has shown by carefully controlled human experiments that when patients are made to walk early, vital capacity returns to normal in one half the time required by bed-confined postoperative patients. Coryllos¹² proved that recumbency greatly reduces the cough reflex; and Cutler¹³ has shown that 50 per cent of all postoperative pulmonary complications are well-established by the end of 24 hours. (This being the case, it is fair to assume that fully 90 per cent of these complications are incipient within this period.) If early rising with its resultant improvement in the depth of respiration and in the cough reflex, can be effective in preventing postoperative pulmonary complications, then it would seem logical to institute this measure during the first few hours of the postoperative period—before the complications have an opportunity to become well-established.

CIRCULATORY COMPLICATIONS

Retardation of the venous circulation is the basic but not the only cause of thrombus formation. It has often been shown that a high degree of slowing takes place after the operation.¹⁴ The Scandinavian, Bauer,¹⁵ has stated that postoperative thrombosis is initiated,

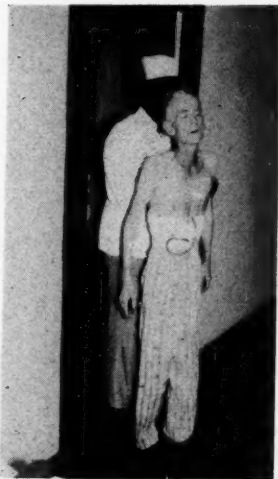


Fig. 3a. Mr. E. H., aged 57, 30 minutes after gastrostomy. Diagnosis: Carcinoma of esophagus with complete obstruction. Anesthesia: bilateral intercostal nerve block and local infiltration. (Cachexia is only a relative contraindication to early rising).

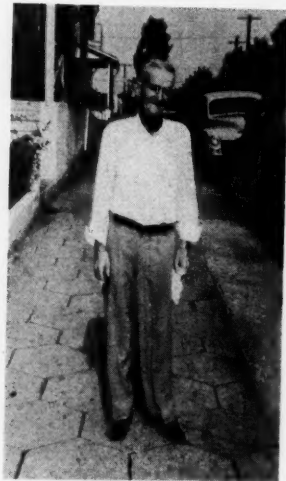


Fig. 3b. Same patient 3½ weeks after gastrostomy. (He died 4½ months after operation of inoperable carcinoma of esophagus with metastasis to lungs.)

in most cases, during the first 24 hours after operation. Best and Taylor¹⁶ have shown that during muscular exercise the blood flow through the active muscles is increased 20 fold or more than during rest. With this increased flow little time is permitted for clotting and any elements for clotting that have accumulated during operation and the immediate postoperative period are washed away. Zava reported no case of pulmonary embolus in 6,000 cases where early postoperative walking was instituted.

With these observations on the physiology of rest and exercise it is reasonable to conclude that pulmonary and circulatory complications, for the most part, have their silent inception within a few hours after operation—if not during the actual operation itself. In our relatively small series of 382 cases started 4½ years ago there has been no major lung complication and no thrombo-embolic disease.

GASTROINTESTINAL COMPLICATIONS

Early ambulation alone will not prevent all gastrointestinal complications, but it contributes directly toward this end by limiting distention through an improvement in muscle tone, and indirectly through its promotion of respiratory and circulatory efficiency.



Fig. 4a. J. T., aged 8 (just before leaving hospital), 34 hours after appendectomy for acute suppurative appendicitis.



Fig. 4b. J. T. at the time of his first office visit on the 4th postoperative day.

These factors, along with the earlier return of appetite, greatly reduces the need for intravenous feedings, gastrointestinal suction and enemas. Instead of the traditional second or third day enema, it is unusual, indeed, for an enema to be given, and the first postoperative bowel movement is frequently accomplished at the patient's home instead of on a bed-pan.

URINARY COMPLICATIONS

Postoperative catheterization is a procedure which, besides being uncomfortable to the patient and disliked by nurses and internes, not infrequently results in infection of the urinary tract that becomes more disturbing to the surgeon and patient alike than the condition for which operation was performed. The need for catheterization can be almost eliminated if the patient is ambulated prior to the time that voiding is necessary. We have not catheterized a patient postoperatively in over 200 consecutive laparotomies.

WOUND COMPLICATIONS AND WOUND HEALING

Probably the most frequently expressed fear by the uninitiated as regards early ambulation is that concerned with wound disruption and incisional hernia. Wound disruption is a serious complication with a mortality rate of 25 to 40 per cent. Leithauser⁸ con-

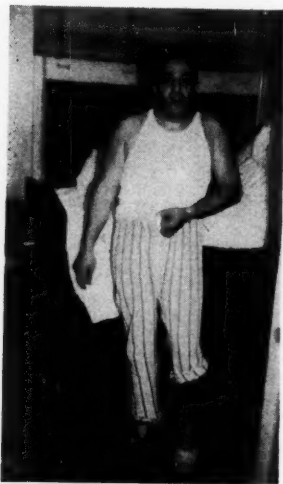


Fig. 5a. Mr. J. D. D., aged 39, seen at his first out of bed period, 5 hours after left inguinal herniorrhaphy for very large, complete, incarcerated hernia.



Fig. 5b. Same patient 24 hours later.

cludes from his own experience and a review of the literature that the high incidence of wound disruptions reported by so many surgeons is due chiefly to three factors: 1. failure to make anatomic incisions, 2. poor choice of suture materials, and 3. prolonged immobilization in bed, which depresses circulation in the area of the wound, delaying healing and leading to atrophy. Other factors such as pulmonary complications, abdominal distention and wound infections, he believes, are contributory rather than basic factors. Surgical wounds are weakest and disruptions usually occur between the seventh and twelfth days. This is the very period when traditionally, most patients have gotten out of bed. Newburger¹⁷ has demonstrated that wound healing and tensile strength are accelerated in laparotomized animals ambulated early as compared with a similar immobilized group. In 1840 consecutive laparotomized patients who were ambulated early, Leithauser reported no wound disruptions and only 2 incisional hernias!

INCISIONS, SUTURES, DRAINAGE

Whenever possible transverse or nearly transverse incisions should be used. This incision splits the fibers of the internal oblique and transversalis muscles and fascia so that no strain is placed on the suture line during contraction of the muscles—but rather, contraction tends to hold the incision together. The midline incision, though not ideal, is probably superior to the mid-rectus incision since in the midline fibers of the aponeurosis of the abdom-



Fig. 6. Mrs. F. B., aged 65, 24 hours after total hysterectomy, bilateral salpingo-oophorectomy and appendectomy for carcinoma of uterus.

inal muscles are fused and interwoven so that sutures are less likely to cut through than is the case with the midrectus incision. The midrectus incision is the most common site for incisional hernia to occur. Non-absorbable suture material is more reliable than catgut, although some surgeons who use catgut with early ambulation report excellent results. In potentially infected wounds alloy steel or tantalum wire has advantages over other suture material. As for drainage in these days of chemotherapy, antibiotics, et cetera, a good rule to follow might be: When in doubt, don't drain!

OBJECTIONS AND CONTRAINDICATIONS TO EARLY POSTOPERATIVE WALKING

Most of the objections are theoretical and the literature which carries these objections for the most part dates back to the early



Fig. 7. Mr. J. G., aged 51, 21 hours after operation (4th out of bed period). Diagnosis: Appendicitis, gangrenous, with perforation and spreading peritonitis.



Fig. 8a. Mr. S. B., aged 55, 4½ hours after operation (1st out of bed period). Diagnosis: (1) Cholecystitis, chronic, with cholelithiasis. (2) Hernia, ventral (epigastric). Operation: (1) Cholecystectomy, with exploration and drainage of common bile duct. (2) Repair of ventral hernia.



Fig. 8b. Same patient 24 hours after "a"—during his 5th out of bed period.



Fig. 9a. Miss S. R. L., aged 26, during 2nd out of bed period, 6 hours after operation. Diagnosis: Cholecystitis with cholelithiasis. Operation: Cholecystectomy and appendectomy.



Fig. 9b. Miss S. R. L. 21 hours after "a," 27 hours after operation.



Fig. 9c. Same patient sun-bathing on roof third day after operation.



Fig. 9d. Miss S. R. L. on 5th postoperative day (showing transverse subcostal incision used for operations on the gallbladder and bile ducts).



Fig. 9e. Miss S. R. L. on 5th postoperative day as she left the hospital.



Fig. 9f. Miss S. R. L. on her 1st visit to office on 8th day after operation.

nineteen hundreds—long before many of the more modern advances in surgery had taken place. Schaeffer and Dragstedt¹⁸ point out that early postoperative rising is possible only because of improvement in surgical technic, strict asepsis, adequate general and local preoperative preparation, better anesthesia, prophylactic and definitive gastrointestinal decompression, restoration and maintenance of fluid balance and recognition of the importance of blood and plasma loss. Three of the current objections are: 1. failure to protect against fatal emboli, 2. interference with wound healing and, 3. fear of medico-legal consequences. The first two have been adequately refuted in the earlier part of this paper; the latter is no longer a valid objection in view of the wealth of literature on the subject and the large number of prominent surgeons and clinics that have adopted the method. To those who object because they believe the postoperative patient to be "too miserable to be subjected to any such activity" I would state the simple fact that patients who are out of bed early after operation are much more comfortable than are patients who are confined to bed. They require fewer hypodermics, fewer parenteral feedings and less nursing care.

Real contraindications are very few. Deep shock, uncontrolled hemorrhage, severe anemia, cachexia, the presence of thrombi or emboli and prolonged preoperative bed confinement may be considered as contraindications. When death is imminent or a hopeless condition exists, the patient is best left in bed also. Leithauser⁹

feels that early ambulation should be denied those patients with long midrectus incisions closed with catgut. However, infection, fever, peritonitis, and mild circulatory deficiency are not contra-indications to the method and moreover these patients do better when they are out of bed several times each day.

ADVANTAGES OF EARLY AMBULATION

Some of the advantages that are claimed for early ambulation are as follows:

1. Asthenia is avoided;
2. Morale of the patient is greatly lifted;
3. Economy to patient and hospital;
4. Surgery is rendered less hazardous, thereby extending operability to a larger group;
5. Simplification of postoperative care;
6. Complications are greatly reduced;
7. More rapid wound healing with consequent earlier return of the patient to normalcy.

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EMBOLUS OF THE FEMORAL ARTERY

Report of a Case

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DURING the recent war it was my privilege to serve with a rather active evacuation hospital in the European Theatre of Operations. In such a position I had the opportunity of seeing a comparatively large number of wounds of the major vessels of the extremities. From the results obtained, my opinion is that in injuries involving the femoral or popliteal arteries usually the prognosis is poor as to survival of the limb involved unless proper and vigorous treatment is instituted early. Since most of our cases were seen relatively late (some 8 to 12 hours after injury) the number of salvaged limbs was small. The same, I believe, would be true regarding sudden occlusion of the vessels due to emboli or thrombosis.

Recently I was called upon to treat a patient who developed an embolus of the femoral artery following an injury to the groin. No attempt was made to remove the embolus surgically because of an infected wound in the area. Treatment consisted of paravertebral lumbar sympathetic blocks, antispastics and anticoagulants. At the present time the limb is still viable, pulse is present but feeble in the dorsalis pedis and posterior tibial arteries and the patient is ambulatory. Apparently he has made a complete recovery. This is 9 weeks after the original injury.

CASE REPORT

Z. W., aged 27, white male, was injured on June 3 when the motorcycle on which he was riding was struck by an automobile. He was seen immediately following the accident. Examination revealed a mild degree of shock and a laceration of the left thigh, parallel to and just below Poupart's ligament. On closer examination it was found that this wound tunneled for a distance of about 6 or 7 inches superiorly under the skin of the abdomen. It did not penetrate the abdominal cavity. The extremity was examined for circulatory changes at that time and both the dorsalis pedis and posterior tibial pulses were present. After the patient recovered from shock the wound was cleaned and sutured. There was slight maceration of the skin and a considerable abraded area in this region. The patient was hospitalized for 4 or 5 days and then allowed to go home in what was thought to be a satisfactory condition.

About one week later the patient returned for dressing and removal of the sutures from the wound. At this time it was noticed that there was slight infection of the skin where it had been abraded by the original injury. The leg, however, was warm and the circulation not embarrassed. The wound was dressed and the patient allowed to return home. Some hours later the same day the patient experienced a sudden, severe, cramp-like pain in the groin and

extending down the entire leg. He returned to the hospital and examination revealed the right leg to be cold, white and pulseless in the groin, popliteal space and in the foot. The patient was complaining of excruciating pain which required morphine for relief.

The patient was immediately given a paravertebral block of the second, third, fourth and fifth lumbar sympathetic ganglia. Immediately following this the patient experienced dramatic relief from his pain, the foot became warmer and some color returned. It remained pulseless, however. At the same time treatment was started with heparin and dicumerol. The foot was lowered and kept exposed to room temperature, and he was given papaverine hydrochloride by mouth, gr. $\frac{1}{2}$ three times a day. Embolectomy was decided against because of: (1) the infection present and (2) the improvement of the circulation of the extremity. After a week of such treatment the limb was still viable but pulseless. He wasn't seen again by me for 2 weeks at which time the condition was essentially the same except for pain and tenderness in the calf muscles. I thought he might be developing a thrombophlebitis so another sympathetic block was given which relieved his pain.

This patient was last seen by me about 9 weeks following his injury and 8 weeks following the embolus. He is fully ambulatory and states that he walks 3 or 4 miles each day without pain. There is no swelling. The posterior tibial and dorsalis pedis pulses are present but feeble. Apparently he has made a complete recovery.

COMMENT

When a peripheral artery is suddenly occluded by an embolus, severe cramp-like pain usually occurs at the site of the occlusion. The pain may involve the entire extremity. There is considerable tenderness to pressure over the involved area. The part distal to the occlusion becomes pale and cold, the temperature and color dependent on the size and location of the vessel involved. Major pulses are absent.

It is important to differentiate between embolism and thrombosis if embolectomy is anticipated because it is impossible to remove a thrombus. In thrombosis the pain is usually not so severe and develops as a rule in older people with such degenerative diseases as arteriosclerosis and thromboangiitis obliterans. They usually have a past history of arterial insufficiency, such as intermittent claudication, numbness, tingling, etc.

Acute arterial embolism is a real emergency requiring prompt and adequate treatment if satisfactory results are to be obtained. The most common cause of gangrene following peripheral embolism is the failure to institute adequate treatment before the arteries distal to the embolus have undergone irreparable damage.

The treatment may be divided into operative and nonoperative treatment. Since the advent of the anticoagulants, it is not necessary to employ operative treatment as frequently as previously.

Conservative treatment aims to: (1) release the concomitant

vasospasm, (2) improve the collateral circulation, (3) relieve pain, and (4) prevent distal secondary arterial thrombosis. The vasospasm can be relieved by 2 measures: (1) the use of papaverine hydrochloride intravenously and (2) interruption of the sympathetic pathways by paravertebral block. The intense arterial spasm is believed to be responsible for the resulting pain and for the closure of collateral vessel openings distal to this site of occlusion. Thus measures to relieve the vasospasm will in turn relieve pain and improve the collateral circulation.

Heparin and dicumerol are employed to prevent propagation of the thrombus and/or formation of secondary arterial thrombosis distal to the lesion. In the case reported the patient was started on a combination of heparin and dicumerol. After adequate dicumerol effect was established as determined by the prothrombin time, the heparin was discontinued and dicumerol continued for 7 days. Specifically he was given 300 mg. of dicumerol in one dose and 100 mg. heparin every 6 hours the first day. The second day 200 mg. of dicumerol and heparin as above. After 2 days it was possible to discontinue the heparin because the dicumerol effect had become sufficiently well established.

Allen has found that although in theory heparin should be administered by continuous intravenous drip, the intermittent injection of it produces satisfactory clinical results. It is also available in Pitkin's menstrum.

Other points in the treatment are as follows: the leg should be lower than the heart and not elevated. Heat should not be applied to the extremity but may be to the abdomen in the form of a heat cradle. Codeine and aspirin, or morphine if necessary, are used for pain. The Pavex and intermittent occlusion apparatus are valuable aids in the treatment.

If after a trial of 4 to 6 hours the circulation does not appreciably improve under the conservative treatment, most authors agree that surgical intervention is indicated. The usual procedure is embolectomy. If, however, after removing the embolus, a fresh flow of blood through the artery is not obtained, it is advisable to ligate the vessel and remove that part of the vessel where the embolus was lodged, thus removing the irritable focus of the vasospastic reflex and facilitating collateral circulation. After embolectomy it is wise to continue treatment with anticoagulants and antispastics for 8 to 10 days.

SUMMARY

A case of femoral arterial embolism following injury is reported.

A brief resume of the diagnosis and treatment of arterial embolism is given.

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TUBERCULOSIS OF THE BREAST

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TUBERCULOSIS of the breast is an uncommon lesion, but occurs often enough to warrant its consideration in the differential diagnosis of breast lesions. The condition was first described by Sir Ashley Cooper in 1829,¹ over 500 cases had been reported by 1939. The incidence of the disease has been reported to vary from 1.4² per cent to as low as 0.88³ per cent in the larger series of breast lesions. In general this disease accounts for about one per cent of the surgical conditions of the breast. It must be considered rare in males since 96 per cent of all tuberculous breast lesions have been reported in females. The disease has been most commonly confused with neoplasm of the breast, and frequently the correct diagnosis has been made only after radical amputation of the breast for a supposed malignancy. Harrington⁴ states the disease is seen once for every 200 cases of breast carcinoma. This condition has been diagnosed only once during the 3 year period 1944-1946, at the Steiner Cancer Clinic. During the same period 114 new cases of carcinoma of the breast were observed.

THE ETIOLOGY AND PATHOGENESIS

The bovine tubercle bacillus is the common causative organism. The manner in which breast tissue becomes infected by these organisms is controversial. Some observers believe that the lesion occurs primarily in the breast during the course of tuberculous bacteriemia. Others believe that the lesion in the breast occurs secondarily to tuberculous involvement of other structures in the vicinity. The breast may be involved either by contiguity or lymphatic extension from the ribs, the pleura, the lungs, the mediastinum, or regional lymph nodes. While primary involvement is possible there is little evidence that this is the usual manner. Nagaskima⁵ in 1925 performed complete autopsies on 34 patients who died from miliary tuberculosis. He sectioned the breasts, subjected them to microscopic examination, made smears and guinea pig inoculations without finding a single case of tuberculous mastitis. Grausman and Goldman⁶ have reported several cases which support the theory of retrograde lymphatic extension from regional tuberculous lymph nodes.

Other portals of possible entry which have been mentioned are the ducts and cracks or abrasions in the nipple.^{7,8}

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PATHOLOGY

A. Gross characteristics have permitted classification into the following groups:

(a) *Nodular*. This is the most common type of lesion. It is characterized by a freely movable and well circumscribed nodule which may vary from one to several centimeters in size. Advanced lesions present draining sinuses in about one third of the cases.

(b) *Sclerosing*. This type is usually seen in elderly patients. It is characterized by a diffuse, ill-defined fibrotic mass in the breast. Attachment to the skin and nipple retraction are frequent. Draining sinuses may be present.

(c) *Atypical*. Certain cases present no distinguishing characteristics which permit grouping under the above headings. These include intraglandular fibrosis, sometimes referred to as obliterating tuberculous mastitis.

B. Microscopic: The histopathologic picture is characteristic. Tubercles with foreign body giant cell formation are noted replacing the glandular structure. The lobules are obliterated and the duct walls are replaced by fibrotic tissue. The stroma shows increased vascularity. The regional lymph nodes are involved in about 60 per cent of cases and differ in no respect from typical tuberculous lymphadenitis as seen elsewhere.

DIAGNOSIS

The disease usually occurs in patients who are in the 20 to 50 year age group and who are in good health. The primary symptom in two thirds of the cases is the finding of a nodule or swelling in the breast. The same percentage of cases usually exhibit draining sinuses at the time of first examination. Pain is an infrequent complaint, being noted in only 8 per cent of cases. The average duration of symptoms is 6 months. The majority of patients present regional node enlargement when first seen.

In the nodular type of tuberculous mastitis the lesion is usually well-circumscribed, freely movable, and may feel cystic. It is occasionally tender. These findings are in contrast to the sclerosing type in which there is a diffuse hard mass to which the skin may be fixed and the nipple retracted. It is in the latter type of lesion that the erroneous diagnosis of carcinoma is usually made. If a draining sinus is noted a correct diagnosis may sometimes be made by microscopic examination of tissue curetted from the sinus; however, it is well to remember that 28 cases of carcinoma and tuber-

culous mastitis occurring simultaneously in the same breast have been reported.⁶

The differential diagnosis is often difficult but may be made easier by separating breast lesions into two large groups.

A. Breast lesions without draining sinuses.

Carcinoma of the breast may be simulated so closely by tuberculous mastitis that the correct diagnosis can only be made by microscopic study of the diseased tissues.

Sarcoma of the breast is a rapidly growing and usually massive tumor. It is soft, mobile, and lobulated. Metastases are frequently present when the patient is first seen.

Chronic cystic mastitis is commonly bilateral, tender, and may be more painful prior to the menstrual period. The skin is not adherent to the lesion and nipple retraction is infrequent. The masses may be cystic or may be felt as shotty nodules throughout the breast tissue.

Benign fibroepithelial tumors are firm, circumscribed, freely movable, are not attached to the skin, and do not cause retraction of the nipple. There is no regional lymph node enlargement.

Fat cell necrosis is rather uncommon and should be considered even without a history of trauma to the breast. The lesion is hard, usually localized, and the skin is adherent to the mass in the majority of cases. The lesion may be suspected in the operating room but final diagnosis depends on microscopic examination.

Acute plasma cell mastitis presents a diffuse tender and painful swelling of the breast early in the disease and regional lymph nodes are enlarged. Later the tumor becomes hard and adherent to the skin. Biopsy of the lesion will reveal the pathology.

Gumma of the breast is rare and a negative serology does not rule out syphilis. The diagnosis can be made only by microscopic examination of the tissue.

B. Breast lesions with one or more draining sinuses.

Carcinoma of the breast with a draining sinus can be differentiated from a tuberculous lesion only by microscopic study of the diseased tissue. A single negative biopsy of the sinus tract does not rule out carcinoma or tuberculous mastitis. It is well to mention again that cases of tuberculous mastitis and malignancy have occurred in the same breast.

Chronic pyogenic mastitis may sometimes be differentiated from tuberculous mastitis by a history of recurrent episodes of swelling

of the breast followed by rupture and drainage from the abscess. In some cases only microscopic study of the involved tissues will reveal the correct diagnosis.

A degenerating gumma is differentiated by the same studies as in the undergenerated lesions.

Actinomycosis of the breast is rare and can be diagnosed by the presence of the ray fungi in the pus or material obtained by biopsy.

PROGNOSIS

The prognosis for the patient with primary tuberculous mastitis is good when prompt treatment is given. Lee and Floyd⁹ state that there are no proved cases of spontaneous cure where a definite diagnosis of tuberculous mastitis had been made. In untreated cases the disease may spread to the thorax and its adjacent viscera.

In cases of secondary tuberculosis of the breast the prognosis depends upon the location, activity, and treatment of the primary lesions.

TREATMENT

Surgery offers the best prognosis in primary tuberculous of the mammary gland. Simple mastectomy is curative for lesions which do not show axillary node involvement. When lymph node pathology is evident, the removal of these diseased nodes should be performed in addition to simple mastectomy. Axillary dissection is recommended when there is extensive involvement. Harrington⁴ states that a radical mastectomy should be done when there is involvement of the fascia and pectoral muscles.

Some authors have recommended segmental removal of a section of the breast with the involved tissues.¹⁰ It is difficult to ascertain when all diseased tissues have been removed.

The use of curettage, cauterization, injection, incision, and drainage as curative surgery are of no value since these methods are inadequate for cure, and in some instances no tissue will be available for microscopic examination.

Edelston¹¹ had good results in one case by the injection of .05 per cent topical promanide jelly into a proved tuberculous sinus of the breast. There are no other reports on the use of this therapy.

Surgical treatment of the lesion should always be supplemented by general supportive measures such as diet, rest, and hygienic living.

REPORT OF CASES

(From Steiner Ward of Grady Hospital)

CASE 1. B. D. W., a negro woman, aged 25, was admitted to Steiner Clinic of Grady Hospital. She had noticed 8 weeks prior to admission a small draining ulcer near the areola of the right breast. A tender, hard, movable mass was discovered in the tail of the breast.

The past history was significant in that she had had an abscess of the right breast drained 10 years previously and it had promptly healed. She had received a complete course of anti-syphilitic therapy 10 years previously and she had one child 15 years of age.

Examination revealed a robust negro female who presented a 1 by 1 cm. ulceration on the medial aspect of the right breast, and a 3 by 4 non-tender, movable, round mass in the tail of this breast. No retraction of skin or nipple was noted and no axillary lymph nodes were palpable.

The routine laboratory tests were within normal limits. A culture from the ulcer revealed no growth of acid fast organisms. Biopsy of the ulcer revealed nonspecific granulomatous tissue. A roentgenogram of the chest was negative.

On Oct. 4, 1946, the right breast and the mass in the tail of the breast were removed. Gross examination revealed the mass to be a caseous lymph node. Microscopic examination revealed tuberculosis of breast tissue, tuberculous lymphadenitis, and mild chronic cystic mastitis.

Postoperative course was uneventful and one year later examination revealed no evidence of disease.

(Additional Case from Surgical Wards of Grady Hospital)

CASE 2. N. K. W., a negro female, aged 43, was admitted to surgical clinic of Grady Hospital. She noticed 6 weeks prior to entry a small, slightly tender mass under the areola of the left breast.

The past history was significant in that she had had no children, but had had two pregnancies terminate in early spontaneous abortions.

Examination revealed a negro woman in good health who presented a 1 by 1 cm. mass under the left areola. It was non-tender and seemed fixed to the skin. A small amount of thick yellow pus could be expressed from the mass. No axillary nodes were palpable.

Laboratory studies were normal except for a leukocytosis of 16,000. Culture of the pus was negative for acid fast organisms.

The mass was excised on Nov. 8, 1941, and microscopic examination revealed tuberculous mastitis. This was followed by simple mastectomy and an uneventful postoperative course.

The patient was seen 7 months later and a small amount of drainage noted at the site of the wound. She was not seen again until 6 years later, at which time the area was completely healed. Subsequently she died following hemorrhage from a bleeding peptic ulcer. No autopsy was obtained.

SUMMARY

1. The etiology, pathogenesis, differential diagnosis, pathology, prognosis, and treatment of tuberculous mastitis are discussed.

2. The diagnosis of this disease can be made with certainty only by microscopic examination of diseased tissue.
3. Any breast lesions presenting a draining sinus should suggest tuberculous mastitis to the examiner.
4. The best results for cure will be obtained by simple mastectomy and removal of involved lymph nodes in primary tuberculous mastitis.
5. Two cases of proved tuberculous mastitis are reported.

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SURGERY OF THE SYMPATHETIC NERVOUS SYSTEM

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As a result of much trial and experimentation in surgery of the sympathetic nervous system great advances have been made. Surgical attack on this nervous system has become well standardized; indications are becoming increasingly clear-cut. Even a casual perusal of literature of the past ten years convinces one of the dramatic advances made in surgery of the sympathetic nervous system.

I. THE SYMPATHETIC NERVOUS SYSTEM IN PERIPHERAL VASCULAR DISEASE

It has been demonstrated repeatedly that man is abundantly supplied with vasoconstrictor impulses, which are mediated by the sympathetic nervous system. As a result the vascular tree is in a state of ever-present fluctuation, responding to cold, pain, emotion, and the upright position.

Many of the peripheral vascular diseases are associated with a spastic as well as an organic component. By overcoming the spastic element—and this can be done by ablating the vasoconstrictor impulses of the sympathetic nervous system—marked improvement in the peripheral circulation can be obtained. Removal of sympathetic impulses is effected temporarily by blocks with novocaine; for longer periods by alcohol blocks; and permanently, by surgical excision. Sympathetic blocks with novocaine are of especial importance diagnostically: such a diagnostic block should precede any surgery. It should be remembered that these temporary blocks are not equivalent to the lasting effects of surgery, but do demonstrate the ability of the vascular tree to dilate and function free of vasoconstrictor impulses. The use of alcohol blocks is markedly restricted because of the danger of alcoholic neuritis. Such a complication can be quite disabling.

A. Raynaud's Syndrome

This includes classic Raynaud's disease and allied vasospastic conditions such as acrocyanosis. Characteristically, exposure to cold or emotional upset produces coldness, duskiness, and cyanosis of the hands or feet. The disease usually occurs in females under the age of forty.

The exact cause of this syndrome is not known. Most investiga-

tors believe it to be due to overactivity of the vasomotor system; many, however, contend that there is a local hypersensitivity of the vessel walls. The disease is likely to be progressive for the chronic anoxemia results in fibrosis, atrophy, ulceration, and gangrene.

Raynaud's disease is characterized by:

(1). Phasic color changes.

Emotional and thermal stimuli produce arteriolar vasoconstriction, resulting in pallor, cyanosis, and/or rubor.

(2). Lack of involvement of the main arteries.

Thus there is no spasm of the radial, dorsalis pedis, or posterior tibial arteries.

(3). Extreme symmetry of involvement.

The most satisfactory method of treating Raynaud's disease is by surgical sympathectomy. Smithwick urges preganglionic section of the sympathetic fibers, theorizing that post-ganglionic section is associated with sensitization of the vessel walls to circulating hormones, especially sympathin or adrenalin. Most clinicians advocate sympathetic ganglion and trunk resection, believing better results to follow more radical procedures.

B. Buerger's Disease (Thromboangiitis obliterans)

This is an inflammatory, obliterative disease of the arteries and veins, which produces ischemia of varying degree in the tissues. Its course is one of exacerbations and remissions; gangrene is frequently a sequela. The medium-sized arteries are most frequently affected. Pain is an outstanding symptom, varying from intermittent claudication to constant, agonizing discomfort. Recurrent or migratory thrombophlebitis is often present during the acute phase of the disease. Buerger's is usually found in males under forty, who have been heavy smokers.

Sympathectomy has proved to be a valuable procedure in the treatment of thromboangiitis obliterans. It is not curative, but does provide maximum arteriolar dilatation and often relieves pain and prevents gangrene. It should, of course, be advised only in those cases in which a diagnostic novocaine block has afforded clinical improvement—i.e. relief of pain, improvement in claudication, and warming of the extremity.

C. Arteriosclerotic Peripheral Vascular Disease

The beneficial results obtained by sympathetic ablation in the above peripheral vascular diseases has led to wider application of this therapeutic procedure. It has been quite gratifying to find an appreciable degree of vasospasm in many cases of arteriosclerotic

peripheral disease (with or without diabetes). In carefully selected cases, sympathectomy has resulted in the saving of many extremities—extremities which have proved to be quite useful to the patient. Alcohol lumbar sympathetic blocks have a wider range of usefulness here than in any other group, since many are poor candidates for surgery.

D. Causalgia

These patients characteristically have continuous, burning pain following relatively minor injuries. The pain is progressive in nature and quite disabling. Within a few weeks, the skin of the involved extremity becomes glossy and atrophic. Osteoporosis or Sudeck's atrophy is frequently associated.

It is likely that this syndrome is based on chronic vasodilatation. Yet treatment with a series of novocaine sympathetic blocks, or sympathectomy in the severe cases, is uniformly successful. It is certainly paradoxical that paralysis of the sympathetics, which usually causes vasodilatation, should aid these patients.

E. Erythromelalgia

This is a disease of obscure etiology which is characterized by redness and burning pain of the extremities. Attacks are brought on by heat, exercise, and dependent position of the extremity. Since arterial pulsations are present and the vessels to the feet greatly dilated, it is somewhat surprising that these patients are aided as much by sympathectomy as they are. It should be remembered that the sympathetic pathways carry vasodilator as well as vasoconstrictor fibers. The explanation of the beneficial results obtained by sympathectomy in both causalgia and erythromelalgia is probably due to ablation of vasodilator impulses, thereby overcoming chronic vasodilatation.

F. Thrombophlebitis

Ochsner and DeBakey have repeatedly emphasized the importance of spasm in thrombophlebitis. Not only is there venous spasm, but arteriolar spasm plays a prominent part in the clinical picture. Sympathetic blocks with novocaine are usually quite dramatic in the treatment of acute thrombophlebitis: the relief of pain is immediate, the temperature returns to normal in 24 to 48 hours, and the edema subsides more rapidly. Early institution of therapeutic sympathetic blocks with novocaine will no doubt decrease the development of post-phlebitic sequelae: edema, dermatitis, and ulceration.

Use of sympathectomy in *selected* cases of "chronic thrombophlebitis" with pain and lymphedema is quite gratifying. There is

usually relief of discomfort, improvement in edema and associated dermatitis, and healing of ulcerations.

G. *Arterial Thrombosis and Embolism*

Ablating the sympathetic nervous system chemically and surgically is most important in treating arterial occlusion due to thrombosis or embolism. With either condition, there is marked vasospasm of collateral vessels. Thus, release of the vasoconstrictor impulses of the autonomic nervous system will relieve ischemia and frequently prevent gangrene.

Similarly, sympathectomy is a useful adjunct to the surgery of aneurysms. It has proved of value in selected cases of frostbite or trench foot.

II. THE SYMPATHETIC NERVOUS SYSTEM IN OTHER NON-RELATED DISEASES.

Other conditions in which the use of sympathetic blocks and surgery have proved quite beneficial include the following:

A. *Poliomyelitis with Vessel Spasm*

In such cases, the impairment in circulation may be so marked as to cause retardation of growth. In young patients in whom the paralysis is not too extensive (for muscular activity is a necessary stimulus to growth), lumbar ganglionectomy is capable of producing about one inch of increased growth in shortened limbs. Such an increase in length does not occur following sympathectomy in limbs of normal length.

B. *Hyperhidrosis of Nervous Origin*

Sweat glands respond to both thermal and psychic stimuli. In certain instances, there may be hyperactivity of the sympathetic nervous system, with resultant excessive sweating, which may be both annoying and incapacitating. When the severity of the hyperhidrosis is such as to warrant surgery, excellent results are obtained by sympathectomy.

C. *Hirschsprung's Disease* (Congenital Idiopathic Megacolon)

In early cases of true idiopathic megacolon, excellent results can be obtained by lumbar sympathectomy. It is indicated when medical therapy has failed. It is well to study the patient under spinal anesthesia to determine the extent of improvement which may be expected by eliminating sympathetic control. In late cases, sympathectomy is of little value; frequently, colon resection with ileosigmoidostomy is necessary in this group.

D. Dysmenorrhea

In intractable primary dysmenorrhea which has defied the usual conservative therapeutic measures, presacral neurectomy or sympathectomy is of distinct benefit. Rigid criteria are essential in selecting suitable operative candidates. Only those who have disabling pain and are not relieved by simpler measures, including dilatation of the cervix, should be subjected to sympathetic surgery. Uniformly optimistic reports are found in the literature; failures are rare; complete relief is obtained in 75 to 80 per cent of cases. It is universally agreed that the operation is quite harmless in its effect on the bladder, bowel, and uterus. Normal parturition occurs following the operation. Presacral sympathectomy should occasionally be combined with other surgical measures in overcoming acquired or secondary dysmenorrhea.

E. Hypertension

Renewed interest in the surgical treatment of hypertension has occurred in the last ten years. This has been due to several factors, including the failure of medical treatment in many cases, the large number of deaths annually from hypertension and its complications, and to the increasing success of attack on the autonomic nervous system.

Admittedly, splanchnicectomy leaves much to be desired in the treatment of hypertension. However, it is the most useful measure we have in our present therapeutic armamentarium when rest and sedation have failed. The mechanism of blood pressure reduction is not entirely clear, but is partially due to widespread vascular relaxation.

Various technics of splanchnicectomy are practiced throughout the country. Adson and Craig of the Mayo Clinic advocate infra-diaphragmatic sympathectomy, reporting 31 per cent to have significant lowering of blood pressure. Peet and his co-workers are strong advocates of a supradiaphragmatic splanchnicectomy, while Crile favors celiac ganglionectomy. The combined supra- and infra-diaphragmatic operation which has been popularized by Smithwick of Boston is gaining popularity since it achieves better results with the same operative risk.

Peet in a recent (1946) follow-up report of 437 cases reports 46.7 per cent of all patients to show a significant reduction in blood pressure 5 or more years following surgery. In this study, improvement in eyeground changes was reported in 80 per cent of cases; 52 per cent of abnormal electrocardiograms were improved. In 50 per cent of patients, heart size was significantly decreased; 36 per cent

showed improvement in kidney function. Smithwick in a follow-up of 156 patients (1944) reports 61.5 per cent to have a persistent diastolic lowering of 20 or more millimeters of mercury. It is likely that the combined supra- and infradiaphragmatic operation will give better results since it is a much more radical procedure; vasoconstrictor impulses to the lower extremities, as well as the entire splanchnic area, are interrupted. Significant lowering of the blood pressure is almost uniformly associated with improvement in the cardiac, renal, and cerebral manifestations of hypertension.

Selection of patients for operation is most important. Suitable candidates are usually under 50 years of age and show a labile type of pressure, responding temporarily to rest and sedation. Careful evaluation of heart, kidney, and cerebral status is necessary. The heart should be compensated. The kidney should be able to concentrate to 1.016 or 1.020; the non-protein nitrogen should not exceed 45 mg. per cent. The state of the eyegrounds is important prognostically and in selecting patients for surgery.

Until more satisfactory therapeutic measures are devised, greater use of surgery in the treatment of hypertension is indicated. Careful selection of patients is essential, for injudicious use of splanchnicectomy will soon bring the procedure into disrepute.

F. Asthma

On the basis that reflex spasm of the bronchi may play a role in the production of asthma, sympathectomy has been advocated. Results have been poor for the most part. Somewhat more encouraging results are obtained by resecting the vagal pulmonary plexus.

G. Miscellaneous

There is meager and debatable evidence that sympathectomy is of value in the relief of intractable bladder pain, early scleroderma, and amputation stump pain. Too little is known to draw conclusions at this time; suffice it to say that results have been neither consistent nor dramatic. It should be emphasized that true phantom limb is a cerebral and not a peripheral disorder. Thus, peripheral surgery will effect little relief.

CONCLUSION

There can be little doubt that marked advances have been made in surgery of the sympathetic nervous system within the past two decades. In properly selected cases, dramatic therapeutic results can be obtained. It is surprising to note the large number of varied

disease entities which can be influenced by sympathetic nervous system surgery.

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PREVENTION OF POSTOPERATIVE PULMONARY COMPLICATIONS OF UPPER ABDOMINAL SURGERY WITH INTERCOSTAL NERVE BLOCK

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Atlanta, Ga.

EARLY attempts to reduce postoperative wound pain by the local infiltration of anesthetic agents did not become popular because of interference with wound healing.¹ Bartlett² described a technic for bilateral intercostal block in 1940 and the anesthesia of the upper abdomen produced by his method became a valuable adjunct of so-called balanced anesthesia. Recognizing that pain is an important factor in the production of postoperative atelectasis, Zollinger³ employed bilateral intercostal block, using eucupine in oil to reduce postoperative wound pain. The effectiveness of the block was measured by vital capacity determination. Zollinger found that the vital capacity following upper abdominal surgery with intercostal block was greater than the median postoperative vital capacity in a similar control group. In 7 of 8 cases of biliary surgery subjected to intercostal block Starr and Gilman⁴ reported that the average postoperative vital capacity was 23 per cent greater than in a control group. Belinkoff⁵ was impressed by the effectiveness of intercostal block in the reduction of postoperative atelectasis. He reported only one case with pulmonary complications in a series of 20 cases of upper abdominal surgery subjected to bilateral intercostal block with Novest Oil.*

RATIONALE

Reference to the mechanism of respiration adequately explains the basis for the effectiveness of intercostal block in the prevention of postoperative atelectasis. Anesthesia of the upper abdomen prevents reflex postoperative spasm of the transversus, external and internal oblique muscles. These muscles are antagonistic to the diaphragm and lower intercostal muscles which latter act as a group to allow adequate expansion of the lower lobes of the lungs. Kahn⁶ demonstrated that stimulation of the central ends of the intercostal nerves caused reflex inhibition of respiration. The reflex inhibition was most pronounced upon stimulation of the seventh through the twelfth intercostal nerves.

A 5 per cent solution of Bromsalizol (monobrom hydroxy-Benzyl

From the Whitehead Department of Surgery, Emory University School of Medicine, Grady Memorial Hospital, Atlanta, Georgia.

*Novacol Chemical Manufacturing Company, Brooklyn, N. Y.

alcohol)** in peanut oil was used in the majority of the cases of this series. Lee, et al,⁷ reported the use of Bromsalizol in oil in lumbar sympathetic blocks in a group of 109 patients. Although not as intense as novocaine, its prolonged effect ranged from 3 to 5 days. The effectiveness of intercostal block with Bromsalizol in this series of 53 cases was judged by the intensity of the analgesia produced in the wound area. This was at times difficult to evaluate because of the wide variation of patients' reactions to pain. Only one instance of true anesthesia was noted. Approximately 10 per cent did not have any apparent relief from wound pain. Failure to inject the anesthetic agent in close proximity to the intercostal nerves probably accounts for these cases. The period of analgesia produced in an effective intercostal nerve block with Bromsalizol in oil was usually from 3 to 4 days. No cases of allergy, neuritis, or tissue slough resulted from the use of Bromsalizol in oil. The intrapleural injection of Bromsalizol occurred in 2 cases but no untoward symptoms were noted. Intracaine in Oil*** was used in 6 cases. No advantages of this anesthetic agent over Bromsalizol were noted.

TECHNIC

The technic of bilateral intercostal nerve block is safe, easily done and requires but little time. Three cubic centimeters of Bromsalizol in oil are injected into each of the lower 6 intercostal spaces bilaterally. The mid-axillary line is the site of choice because it is at this point where the lateral cutaneous branch of the intercostal nerve originates. This branch participates in the innervation of the rectus abdominis muscle and cutaneous innervation of the anterior abdominal wall. The solution is injected into the space between the external and internal intercostal muscles. The lower border of the rib is the main reference point, and it affords an accurate estimate of the depth of the needle. A number 19 gauge needle permits easy flow of the oily solution. The block is routinely done at the conclusion of the operation. It usually requires about 10 minutes for completion, and the time is halved when both sides are injected simultaneously. Preoperative bilateral intercostal block to obtain maximum effect during operation would be ideal. However, the discomfort of multiple needle punctures along the chest wall dictates that the block be done while the patient is under a general anesthetic.

RESULTS

Fifty-three unselected cases of upper abdominal surgery were subjected to bilateral intercostal nerve block. There were 5 cases of postoperative atelectasis, or an incidence of 9.4 per cent. This

**Hynson, Wescott, & Dunning, Baltimore, Md.

***E. R. Squibb & Son, New York.

group of 53 cases included 10 gastrectomies, 16 closures of ruptured peptic ulcers, 10 cases of biliary surgery, 7 traumatic upper abdominal cases and 10 operations for various other upper abdominal diseases. In a similar group of 50 cases not subjected to intercostal block, the incidence of atelectasis was 30 per cent. No age or sex difference in incidence was noted in either series. Observations were confined to cases requiring upper abdominal surgery because of the high incidence of postoperative atelectasis in this group. Mason and Zintel⁸ state that the incidence of atelectasis in the male following gastric or duodenal surgery is 66 per cent. The poor general condition common to charity patients and large number of emergency and traumatic cases are important factors which served to increase the incidence of postoperative atelectasis in this series. The criteria for the diagnosis of postoperative atelectasis were fever with cough, diminished breath sound, dyspnea, rales and the more advanced signs of dullness, tracheal shift and cyanosis. A roentgenogram of the chest was obtained when any of these signs were evident. X-ray of the chest was not found to be reliable in the early diagnosis of postoperative atelectasis.

SUMMARY

Clinical observation of the 53 patients subjected to bilateral intercostal nerve block created the impression that, in general, there was less postoperative wound pain, and as a result less sedation was required. These patients were able to breathe and cough more easily. Turning in bed became less of an ordeal, and early ambulation was more readily accepted by these patients. These advantages contribute to a reduction in the incidence of postoperative pulmonary complications. A local anesthetic agent with both an intense and a prolonged effect would further increase the effectiveness of intercostal block in the relief of wound pain and prevention of postoperative pulmonary complications.

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FELLOWSHIP ADDRESS

It is a high honor and privilege to be asked to address and welcome into fellowship the 217 new members of the Southeastern Surgical Congress. As you accept this pledge I congratulate you upon reaching this significant milestone in your careers, and congratulate the Congress upon acquiring such a large group of accredited initiates.

After a thorough study of who and what you are, and what you have accomplished, by fair and capable committees you have been given this fellowship. Thus you are entitled to all the privileges and honors of full membership. By attendance at such sessions as the one now in progress we are confident you will be well repaid by what you learn and the happy friendships you will make. In return we ask that you contribute to the Congress of your talents and loyalty. We wish you profit and pleasure in your fellowship.

Before speaking further I would like to pay a well-merited tribute to the man who conceived this organization and its journal, breathed the breath of life into it, and has kept it very much alive and prospering these eighteen years. His success has been due to

Read before the sixteenth annual Postgraduate Surgical Assembly of The Southeastern Surgical Congress, Hollywood, Fla., April 5-8, 1948.

vision and hard work. That his programs have rendered material aid to surgical progress in the Southeast is unmistakable. Not only have the speakers at the annual Congresses been among the best the country affords, but an unique and original feature has been introduced in holding sectional meetings in smaller centers which have been attended by doctors who do not go to the larger gatherings. Thus knowledge of new things in surgery has been disseminated throughout the land. The body has grown from a handful of members to more than twelve hundred, in eleven states. Few men seem to have a genius for building organizations of this kind, and Dr. Ben Beasley is one of them. Let's give him a hand!

Tonight, as a fellowship address, I shall sketch briefly some of the high spots in the history of surgery during the past century, with a look into the changing surgery of today. In 1842 Crawford Long administered the first surgical anesthetic, which was to be followed four and a half years later by the first demonstration before a medical audience, by W. T. G. Morton, aided indispensably by the Boston surgeons Bigelow, Warren and Hayward. Up to this time surgery had made but very little real progress in more than one thousand years. How could any but operations like amputations and ligations be done without means to prevent the agonizing pain? You will read that sometimes various drugs were administered in an effort to mitigate the suffering, but these were rarely successful, and during the first part of the nineteenth century the leading surgeons appeared to abandon all methods to avoid pain. They had the idea that it was a reflection on their skill that they had to resort to any kind of soporific. What they depended upon in operating was speed, and they had it. It is written that Napoleon's surgeon, Baron Larrey, and men of his class, could perform a shoulder-joint disarticulation in one minute. Before the patient realized what was being done, his limb was off. Mesmerism was successful for a while, but not every doctor could use it, and not every patient could be anesthetized by it. The big operation of the times was cutting for bladder stone, of which there were many cases. Three minutes was the usual time allowed for this procedure, and the leading surgeons could do it that rapidly. Benjamin Dudley, of Kentucky, was one of the world's greatest lithotomists, and it is recorded that in his first hundred cases he did not lose a patient. Ephraim McDowell, another Kentuckian, discovered another need for anesthesia besides pain relief. When he did his famous ovariectomy upon Jane Todd Crawford in 1809, the patient sorely needed abdominal relaxation. Evisceration almost caused the laparotomy to be a failure.

How could an operation be performed without some form of

anesthesia? Simply by having the patient tied down, with plenty of people to hold him. Sometimes he got away. In a London hospital there was a large bell. When it rang it was a signal for everybody not otherwise engaged, nurses, orderlies and doctors, to rush in to assist in holding a patient who was about to be submitted to operation. It is said that the operating room not only was placed on the top floor in order to have the advantage of a skylight, but also that the yells and imprecations of patients undergoing operative surgery could not reach the ears of the rest of the occupants of the institution. Occasionally a stoical patient withstood an amputation without apparent signs of suffering, as in the case of Lord Nelson, the English admiral, who lost his arm at the battle of Tenerife, in 1797. His only complaint was that the surgeon's instruments were *cold*, and he ordered that thereafter only *warm* instruments should be used.

Fortunately, and necessarily, surgical procedures before the introduction of anesthesia were few, and were attempted only as a last resort. During the five years immediately preceding the advent of anesthesia only 184 operations, three a month, were performed at the Massachusetts General Hospital, a surprising total for such a large institution, but enough without anesthesia. The procedures were confined chiefly to the surface of the body, including excision of tumors, amputation of limbs and breasts, ligations, plastic operations, herniotomy and lithotomy. The number of operations trebled during the five years following the first use of ether. On account of the controversy which arose concerning who was the discoverer of anesthesia, the method gained much publicity, and became generally accepted and adopted far earlier than the idea of antiseptics, which every one admitted owed its origin to Joseph Lister. The acceptance of anesthesia was delayed through religious opposition, and man's reluctance to adopt new things, which he has outgrown today.

But robbing surgery of its pain was not all that needed to be done. There was still another horror, sepsis, to be overcome. Ligatures and sutures were left hanging out of wounds so they would drop off and not remain inside to keep up infection. (Sometimes I wish I had followed this method when I have to reopen an incision to remove a non-absorbable infected silk suture.) So-called "laudable pus" was still to be expected. In the American War Between the States the frequency of pyemia was appalling, yielding a death rate of 97 per cent, while the mortality in compound fractures was 66 per cent. Due to the incidence of infection injured limbs were sacrificed which today would be saved. In 1865, two years before Lister published his first paper on antiseptics, at St. Bartholomew's Hospital, probably the largest in London, the annual number of

operations for five years was 370, of which 21 per cent were amputations, with a mortality of 30 per cent. Among 21,490 operations performed at the Grady Hospital, Atlanta, in 1947, amputations numbered 60, an infinitesimal percentage. There were 3 deaths, a mortality of .5 per cent.*

Is it any wonder infection was rampant in the preantiseptic era, when James Y. Simpson, Queen Victoria's famous obstetrician, wrote as follows? "The operating table was of wood, and of fabulous age. It was sometimes thought necessary to have a new mattress for the table when the stuffing was found to be matted together in lumps by the blood, which during many years had soaked through its covering. The only correct garb for the surgeon was a frock-coat (the oldest and shabbiest in his wardrobe), which was kept in the surgeon's room, and never renewed or cleaned during his twenty years of operative work."

And then, from Lawson Tait, the renowned contemporary of Lister, these words: "In preparing to operate, Syme (father-in-law of Lister, and a distinguished surgeon), always turned up the sleeves of a dressing coat in which he might have just shown himself before his queen at Windsor. The operating theatre attendant was permitted to employ his spare time in the post-mortem room; the surgeons came straight from the dissecting room to operate, after simply washing their hands. Ligatures were used which already had been soiled by handling with blood-stained fingers to bind up wounds in a second case. And at Edinburgh these ligatures were always worn ostentatiously by the house surgeons, like a badge of knighthood in the button-hole of a coat which often rivalled that of his chief for dirt and condition."

Amazingly improved results were brought to surgery by antiseptics, although many years were required for its universal adoption. Gradually, through the teachings of von Bergmann, Billroth and others, aseptic technic evolved from antisepsis.

Next came the cystoscope, introduced in 1877 by Nitze, and the x-ray, in 1895, by Roentgen. Many other instruments and methods became available to the surgeon so that operative technic appeared to have attained its limit, so much so that about the time of World War I Lord Moynihan was led to declare that "the craft of surgery

*Through the courtesy of the Office of the Surgeon General of the Army the following statistics are available, in regard to World Wars I and II:

	Cases	Mortality Rate
World War I		
Pyemia, surgical and Septicemia	236	44.5%
Fracture, compound (non-battle)	6,234	11.0%
Fracture, all (battle)	25,272	11.0%
World War II		
Pyemia, Septicemia, Sappremia	1,063	6.0%
Fracture, compound (non-battle)	64,605	6.5%
Fracture, all (battle)	Data not available	

has in truth nearly reached its limit in respect both of range and safety." These words had scarcely been spoken when transurethral prostatic resection first came into vogue. And thus surgery has advanced from one triumph to another, and the end is not yet. In the words of the poet, Rosetti,

"And though thy soul sail leagues and leagues beyond,—
Still, leagues beyond those leagues, there is more sea."

I have called attention to these well-known facts especially to remind the young surgeon of today what a wonderful heritage is his. He is handed a priceless art and science which it has taken centuries to build, and with blood, sweat and tears. Not only should he make the best use of the knowledge already acquired, but be constantly alert for something better, remembering always that it is not the multitude of reported cases which determines the value of a new agent or method, but time, time the final arbiter. How many acclaimed and promising new ideas have we seen relentless time force into the discard! There are tried, true and long-established principles which we can never afford to disregard. Occasionally something new gains a foothold and remains with us. In the maze of highly-prized examinations by instruments of precision and laboratory methods don't let go of the stout thread of clinical judgment. It sometimes may decide the issue.

Although the early history of surgery seemed to accomplish but very little, we should not disparage the efforts of any age, because each generation has built upon the successes and failures of its antecedents. Besides, some day we may come in for criticism and pity by our descendants. Can we possibly conceive of the surgery of the future? Do signs now show indications for more surgery, or need for less? The remarkable development of chest surgery since World War I illustrates how far wrong was Lord Moynihan in thinking the limit of our craft had been reached. The successful operative treatment of bronchiectasis and pulmonary tuberculosis is adding a brilliant and happy chapter to the record. Good results in the surgical attack on the heart and great blood vessels, by Blalock and others, are being achieved by more and more surgeons as much as the news would startle old John Hunter, and even surgeons of three decades ago.

How much are new discoveries and inventions displacing the operative surgery of yesterday? I recall how the mutilating oophorectomies of by-gone days have been supplanted by the intelligent use of hormone therapy. This is an old story, as is the cure of pyosalpingitis by sulfa drugs. M. Y. Dabney reminds me of the successful treatment of follicular cysts by stilbestrol, while Cal-

houn MacDougall¹ says that antibiotics have reduced the number of mastoidectomies by 75 per cent. The same is true of osteomyelitis. Harold McDonald believes genito-urinary diseases owe more to the sulfonamides and chemotherapy than any other class of cases, but they have not reduced the indications for operative intervention in a corresponding degree, since most of the major operations of urology call for the mechanical relief of obstruction.

Penicillin has made thoracotomy for empyema almost a thing of the past, by reducing the incidence of the complication and relieving it after its appearance. Testosterone in breast cancer shows signs of lending valuable assistance to the operative treatment.² Charles Huggins, who made a distinct contribution to the treatment of carcinoma of the prostate by orchiectomy, in a recent editorial in *Surgery, Gynecology and Obstetrics*³ discusses optimistically the chemotherapy of cancer, which apparently is the next agent to which we must appeal for help to our too frequently failing surgery. Yet aid may come from a source of which today we do not dream. Atomic energy may play a role. Certainly it is a mistake to declare, as some have done, that neither the cause nor the cure of cancer will ever be found.

In the meantime we shall continue to employ, to the best of our ability, the means at our command to relieve human suffering and prolong life. We have a record of which we may well feel proud, but can never afford to be satisfied. Always there is more to learn and more to do. New members of the Congress, we bid you welcome and ask you to join us in improving our knowledge and our skill, to the end that we may pass to future generations, unsullied and shining more, the glorious heritage which has been bequeathed to us.

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1. McDougall, C.: *Oto-Laryngology, Past and Future*. Chairman's Address, Section of Ophthalmology and Otolaryngology, Southern Medical Association, Baltimore (Nov.) 1947.
2. Davison, T. C., and Letton, A. H.: *Testosterone in Far Advanced Breast Cancer*, *South. Surgeon*, 74:170-184 (March) 1948.
3. Huggins, C.: Editorial, *The Chemotherapy of Cancer*, *Surg., Gynec. & Obst.* 85:660-662 (Nov.) 1947.

